Technical Memorandum

for

SA5 and Axtell Creek Contaminated Sediment Removal Operations

Portage Creek Area Removal
Kalamazoo, Michigan

Prepared for:

USEPA Region 5
Emergency Response Branch
77 West Jackson
Chicago, IL 60604

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1. INTRODUCTION

Environmental Quality Management, Inc. (EQ) has been tasked with performing a time-critical-removal action (TCRA) to remove polychlorinated biphenyl (PCB) contaminated sediments from targeted locations over a 1.8-mile section of Portage Creek. The Portage Creek Area Site (Site) is a portion of the Allied Paper/Portage Creek/Kalamazoo River Superfund Site. Located in Kalamazoo County, Michigan, this site is pervasively contaminated with PCBs as a result of historic waste practices associated with several paper mills. The Site was listed on the National Priorities List (NPL) on August 30, 1990. The Portage Creek Site is located in the City of Kalamazoo, Michigan, beginning at East Cork Street and extending northward approximately 3 miles to the confluence of the Kalamazoo River. Activities associated with this removal action are anticipated to occur in segments along a 1.8-mile stretch of Portage Creek. Work activities will move downstream primarily between Reed Avenue to East Walnut Street bridge, South Pitcher Street bridge to the railroad crossing west of Rochester Street, and the bend in Portage Creek east of Rochester Street to the confluence with the Kalamazoo River (Figure 1, Site Location Map, Attachment 1).

A comprehensive description of the project is provided in the Work Plan (composed of sediment removal area technical memorandums and other site documents) for the Portage Creek Area Time-Critical Removal Action. The section of Portage Creek targeted for action has been divided into 10 distinct removal areas (Figure 2, Sediment Removal Areas, Attachment 1). The areas targeted for removal will be referred to as SA1-A, SA1-B, SA1-C, SA3-A, SA5-A, SA5-C, Axtell Creek, SA5-D, SA6, and SA7. This technical memorandum will focus on establishing support facilities and contaminated sediment removal operations in the SA5 and Axtell Creek Areas. Approaches described in this technical memorandum supersede all other removal approaches discussed to date in related submittals.

2. PROJECT PREPARATION

EQ will perform the following activities to prepare the Portage Creek Area Site for contaminated sediment excavation in SA5 and Axtell Creek.

2.1 Pre-excavation Sampling of Data Gap Area SA5 and Axtell Creek

2.1.1 Sampling

EQ will conduct sampling at dredging area SA5 and Axtell Creek to further define the extent of contamination and to finalize the removal depths required. All SA5 and Axtell Creek grids will require pre-dredging sampling. Grids SA5D-1, SA5D-2, SA5D-3, SA5D-4, SA5D-7, SA5D-12, and SA5D-14 were sampled prior to preparation of this plan on August 30, 2011. Analytical results of sampling may impact work described in this Technical Memorandum. Approaches described hereafter may be modified subject to the outcome of the investigation.

Future sampling efforts will be performed jointly with the USEPA START Contractor. EQ will supply sampling equipment and supplies. The START representative will be responsible for preparing and labeling samples, completing chain-of-custody, and packaging samples for shipment. Details regarding sampling, procedures, and protocols are presented in the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP). In addition, EQ will collect samples so that waste characterization analyses can be conducted as part of the process for securing disposal acceptance of the TSCA waste soils/sediments and Subtitle D waste soils/sediments.

2.1.2 Analyses

EQ will provide laboratory analyses of the collected samples. Details regarding sample analyses, turnaround time, and QAQC levels are presented in the FSP and QAPP.

3. SA5 AND AXTELL CREEK CONTAMINATED SEDIMENT REMOVAL

The SA5 dredging area lies to the north of the Lake Street bridge and extends north to Walnut Street. SA5 is subdivided into four segments. SA5D extends north of the Lake Street bridge to E Crosstown Parkway. SA5C extends north of E. Crosstown Parkway, to E. Vine Street. SA5B extends northeast from the Vine Street bridge to E. Dutton Street bridge. SA5B is to be re-sampled to verify contaminant levels, and no discussion of dredging work for this dredging area will be addressed in this technical memorandum. SA5A extends northeast from E. Dutton Street Bridge to the Walnut Street Bridge. Dredging will be performed in SA5A, SA5C, and SA5D. The sediment removal depth extends from 30 to 56 inches below the existing creek bottom, which includes an estimated 6 inches of over-dredge depth.

The segment of Axtell Creek to be dredged extends from a storm drain outlet east of the John Street and E Crosstown Parkway intersection and extends east to the confluence with Portage Creek, just west of Upjohn Park. The sediment removal depth for this dredging area extends from 18 to 30 inches below the existing creek bottom, which includes an estimated 6 inches of over-dredge depth.

The overall surface area to be dredged in Axtell Creek and SA5 is anticipated to be approximately 8,387 square yards (sy). The approximate overall dimensions are 2382 ft long by 36 ft wide. EQ will dredge sediments that will require TSCA disposal [approximately 3947 cubic yards (cy)] and sediments requiring non-TSCA disposal at a Subtitle D Landfill (approximately 5,397 cy).

The SA5A Dredging Area is subdivided into 6 grids (SA5A-1 through SA5A-6). SA5A will require additional investigatory sampling but currently has only 1 grid that that will be completely disposed of as TSCA waste (SA5A-1). SA5A is anticipated to have 3 grids with sediments that will be completely disposed of as non-TSCA waste (Subtitle D Waste) (SA5A-2, SA5A-3, SA5A-6). SA5A has 2 grids that will require both TSCA and non-TSCA disposal (SA5A-4, SA5A-5)). The sediment dredging areas are depicted in Attachment 1, Figure 3, SA5A

PCB Concentrations and Sample Depths. Table 1 summarizes current excavation information specific to Area SA5A.

Table 1. SA5A Excavation Details

Excavation Area	Dimensions	Removal Depth	Surface Area/Volume of TSCA Soils	Surface Area/Volume of Subtitle D Soils
SA5A-1	30'W by 64'L	48"	1683 sf/249 cy	611 sf/90 cy
SA5A-2	32' W by 63' L	48"	0/0	2056 sf/305 cy
SA5A-3	32'W by 63' L	48"	0/0	2052 sf/304 cy
SA5A-4	25' W by 66' L	48"	691 sf/102 cy	1395 sf/207 cy
SA5A-5	28' W by 64' L	48"	407 sf/60 cy	1573 sf/233 cy
SA5A-6	34' W by 77' L	48"	0/0	2631 sf/390 cy

The SA5C Dredging Area is subdivided into 7 grids (SA5C-1 through SA5C-7). All SA5C grids currently indicate disposal as TSCA waste. Additional investigative samples will be collected in SA5C prior to excavation to confirm TSCA and non-TSCA sediment volumes. The sediment dredging areas are depicted in Attachment 1, Figure 4, SA5C Dredging Area Site Infrastructure. Table 2 summarizes excavation information specific to Area SA5C.

Table 2. SA5C Excavation Details

Excavation Area	Dimensions	Removal Depth	Surface Area/Volume of TSCA Soils	Surface Area/Volume of Subtitle D Soils
SA5C-1	40.5'W by 85'L	36"	2369 sf/263 cy	0/0
SA5C-2	40.5' W by 56' L	36"	2268 sf/252 cy	0/0
SA5C-3	40.5'W by 56' L	36"	2268 sf/252 cy	0/0
SA5C-4	42.5' W by 56' L	52"	2380 sf/396 cy	0/0
SA5C-5	42.5' W by 65' L	52"	2763 sf/460 cy	0/0
SA5C-6	34.5' W by 63.5' L	52"	2190sf/365 cy	0/0
SA5C-7	34.5'W by 21' L	52"	724 sf/120 cy	0/0

The SA5D Dredging Area is subdivided into 17 grids (SA5D-1 through SA5D-17). SA5D has 1 grid that will be disposed of as TSCA waste (SA5D-17). SA5D will have 8 grids that have sediments that will be disposed of as non-TSCA waste (Subtitle D Waste) (SA5D-1 through SA5D-6, SA5D-13, and SA5D-14). SA5A has 8 grids that require TSCA and non-TSCA disposal (, SA5D-7 through SA5D-12, SA5D-15, and SA5D-16). The sediment dredging areas are depicted in Attachment 1, Figure 5, SA5D Dredging Area Site Infrastructure. When dredging operations are conducted in grids with TSCA and non-TSCA waste, TSCA waste will typically be removed first; however, this approach will be flexible to adjust for the complexity of the removal grid. This general approach will allow for segregation of the TSCA material from the Subtitle D material. Table 3 summarizes excavation information specific to Area SA5D.

Table 3. SA5D Excavation Details

Excavation Area	Dimensions	Removal Depth	Surface Area/Volume of TSCA Soils	Surface Area/Volume of Subtitle D Soils
SA5D-1	33.5'W by 76'L	36"	0/0	2546 sf/236 cy
SA5D-2	42' W by 60' L	36"	0/0	2520 sf/280 cy
SA5D-3	42'W by 60' L	36"	0/0	2520 sf/280 cy
SA5D-4	43' W by 60' L	36"	0/0	2580 sf/286 cy
SA5D-5	45' W by 55' L	36"	0/0	2475 sf /275 cy
SA5D-6	43' W by 60' L	18"	0/0	2580sf/143 cy
SA5D-7	45'W by 60' L	30"	195 sf/18 cy	2505 sf/232 cy
SA5D-8	42' W by 60'L	30"	1220 sf/112 cy	1300 sf/120 cy
SA5D-9	42' W by 60'L	30"	782 sf/72 cy	1738 sf/160 cy
SA5D-10	45' W by 56' L	30"	570 sf/52 cy	1950 sf/180 cy
SA5D-11	42' W by 60'L	42"	693 sf/89 cy	1827 sf/237 cy
SA5D-12	39' W by 60'L	42"	420 sf/54 cy	1920 sf/248 cy
SA5D-13	39' W by 64'L	12"	0/0	2496 sf/92 cy
SA5D-14	36' W by 67'L	36"	0/0	2412 sf/268 cy
SA5D-15	38' W by 67'L	42"	2294 sf/382 cy	252 sf/42 cy
SA5D-16	38' W by 68'L	42"	1615 sf/209 cy	969 sf/126 cy
SA5D-17	33' W by 37'L	42"	1221 sf/158 cy	0/0

The Axtell Creek Dredging Area is subdivided into 5 grids (AXC-1 through AXC-5). Axtell Creek has 2 grids that that will be completely disposed of as TSCA waste (AXC-2and AXC-4), 1 disposed of as non-TSCA waste (Subtitle D Waste) (AXC-5) and 2 disposed of as both TSCA and non-TSCA waste AXC-1 and AXC-3. The sediment dredging areas are depicted in Attachment 1, Figure 6, Axtell Creek Dredging Area Site Infrastructure. Table 4 summarizes excavation information specific to Axtell Creek.

Table 4. Axtell Creek Excavation Details

Excavation Area	Dimensions	Removal Depth	Surface Area/Volume of TSCA Soils	Surface Area/Volume of Subtitle D Soils
AXC-1	16'W by 150'L	24"	598 sf/44 cy	2193 sf/162 cy
AXC-2	25' W by 100' L	30"	2500 sf/231 cy	
AXC-3	24'W by 102' L	24"	1348 sf/10 cy	2314 sf/171 cy
AXC-4	24' W by 98' L	30"	2352 sf/217 cy	0/0
AXC-5	28' W by 60' L	24"	0/0	1680 sf/124 cy

3.1 Pre-Sediment Removal Preparation

3.1.1 Waste Characterization Sampling of TSCA/Subtitle D Soil

EQ will collect characterization soil samples of the TSCA and Subtitle D soils prior to excavation. The EQ FSP dated August 2011 provides information on the number of samples,

collection method, and exact analyses to be performed. Both the TSCA and Subtitle D waste soils will be analyzed for landfill disposal parameters.

3.1.2 Pre-Sediment Removal Condition Assessment

EQ will provide a structural engineer to perform a pre-sediment removal assessment of constructed features in and adjacent to the creek channel excavation areas. These constructed features include but are not limited to bridges, storm sewer outfalls, retaining walls, building foundations, and fences. The structural engineer will:

- Inventory the constructed features in the work zones by performing a physical inspection and construction records review.
- Document the pre-existing condition with a written assessment and photographs.
- Prescribe protective measures to maintain the current condition such as (but not limited to) safe set-back distance, shielding, and shoring.

Approaches described in this technical memorandum may be modified subject to the Pre-Removal Condition Assessment.

3.1.3 Temporary Fence Line Installation

EQ will need to install a temporary fence line around SA5D, SA5C, SA5B, and SA5A work areas to control access for public and worker safety. EQ will perform work at the removal areas in ascending order to remove contaminated sediments from upstream to downstream. EQ expects to perform SA5D and Axtell Creek sediment removal somewhat concurrently, while SA5C, SA5B, and SA5A will be performed more consecutively. Therefore, only one removal area will typically be isolated at a time with fencing. As operations are being completed in one removal area, however, preparation activities may begin in the next downstream removal area, which will begin with the erection of a barrier fence line. EQ will install either orange construction fencing or modular chain link fencing panels to isolate work areas from public access. However, EQ will use chain link fencing to isolate the SA5D work area from Upjohn Park and the Kalamazoo Youth Center. Footpath access between Upjohn Park and the Kalamazoo Youth Center will remain open through August 20, 2012 to maintain youth programs where access to and from the youth center and the park is required. SA5D will have fencing erected approximately 40 feet from the east bank of the creek (excluding truck turnaround areas

at each end) from Lake Street to E Crosstown Parkway to isolate the work area from the remainder of Upjohn Park. Additional fencing will be installed on the west side of the creek to block the pathway connecting the Kalamazoo Youth Center to Upjohn Park after August 20, 2012 as previously mentioned. The fence line installation location is depicted on Attachment 1, Figure 5, SA5D Dredging Area Site Infrastructure.

Temporary fencing will be erected on the eastern side of SA5C approximately 40 feet out from the east bank of the creek to provide a suitable work area along the creek. Temporary fencing will also be installed along the side of the creek approximately 5 to10 feet from the west bank and/or just west of the tree line along the west bank of the creek. Fencing on both sides will extend from E Cross Town Parkway to E. Vine Street. Access gates will be installed on fence lines parallel to E. Vine Street and E Crosstown Parkway for transfer truck access. The fence-line installation location is depicted on Attachment 1, Figure 4, SA5C Dredging Area Site Infrastructure.

EQ will temporarily remove existing fencing that is an obstruction to sediment removal and will re-install fencing upon completion of site activities at the SA5A Dredging Area. EQ will utilize existing fencing and install temporary fencing to isolate the dredging area, equipment staging area, bypass and isolation pumps, and transfer truck route, as needed, subject to access restrictions determined by the property owners. EQ will develop a closure / alternative traffic plan and temporarily close the East Dutton Street bridge during dredging operations in order to stage the creek bypass pumping system.

3.1.4 Clearing and Grubbing of Access Road and Excavation Area

Clearing and grubbing will need to be performed at each dredging area covered in this Technical Memorandum. Clearing and grubbing may be very minimal to very extensive subject to the vegetative cover that will restrict access to the dredging areas.

EQ will clear and grub the entire eastern bank of the creek channel along the length of SA5D to facilitate dredging. The southern bank of Axtell Creek will be cleared in vegetated areas up to the confluence with Portage Creek. Clearing and grubbing of vegetation will extend from north of the Lake Street bridge to just south of the E Crosstown Parkway bridge crossing, along the

eastern creek bank edge. EQ will selectively clear vegetation from the western bank of the remainder of SA5D by removing limbs and branches that encroach on the dredging area. EQ will perform additional clearing and grubbing from the west bank in the area of Removal Grid SA5D-7 to extend an access road from a temporary bridge installed in SA5D-7 to the east side of the John Street TCRA Staging Pad. This will include a turnout to the north to allow dump trucks to turn around and back up on to the east end of the staging pad. EQ intends to preserve the vegetative cover along the western bank as much as possible. EQ also intends to perform all clearing and grubbing in such a manner to protect the root mass in the overall work area to maintain soil stability. EQ will use a brush hog mower affixed to a posi-track loader to clear underbrush from both creek banks where accessible and as needed.

EQ will clear and grub the entire eastern bank of the creek channel along the length of SA5C to facilitate dredging. EQ will perform limited clearing and grubbing along the western bank of SA5C and selectively clear vegetation from the western bank of the remainder of SA5C by removing limbs and branches that encroach on the dredging area while preserving as much of the vegetative cover along the western bank as much as possible. EQ also intends to perform all clearing and grubbing in such a manner to protect the root mass in the overall work area to maintain soil stability.

EQ will clear and grub the entire eastern and western bank of the creek channel along the length of SA5A to facilitate dredging. . EQ will perform all clearing and grubbing in such a manner to protect the root mass in the overall work area to maintain soil stability. Tree tops and tree trunks will be handled as described in the EQ Debris Management Plan dated September 2011.

3.1.5 Environmental Controls

EQ will install environmental controls per requirements established in the EQ Sedimentation and Erosion Control Plan dated September 2011. These environmental controls will include the following Best Management Practices (BMPs):

- Storm Drain Inlet Protection—EQ will install filtration fabric in storm drain inlets that are potentially impacted by site operations. EQ has identified the following inlets:
  - In the area near SA5A-1, there are 2 storm water inlets on both sides of Dutton Street, east of the entrance to the work area, there is a 12-inch storm drain that will require protection.

  - In the area near SA5C-7, there are 2 storm water inlets on both sides of Vine Street east of the exit from the work area for a 24-inch storm drain that require protection.
  - In the area near SA5C-1, there are 2 storm drain water inlets on both sides of E Crosstown Parkway just east of the entrance to the work area for a 12-inch storm drain that require protection.

- Construction Exits—EQ may install construction entrances in the SA5 work areas as needed or requested by the land owners. The locations of anticipated construction exits are depicted on Figures 3 and 4. Installed construction exits will either consist of an 8-ounce geotextile underlayment with a 6-inch-thick layer of 1- to 3-inch rock or HDPE construction mats or concrete aprons. The construction exits will be approximately 15 ft wide.
- Tire Wash Station—EQ will install and operate a tire wash station(s) prior to the construction exits described above. The tire wash station will consist of modular unit suitable for supporting loaded dump trucks. After each truck is loaded with exhumed sediment, laborer(s) equipped with high-pressure water washer(s) will spray off the dirt from truck tires as they pass through the tire wash station prior to exiting the site. The dislodged dirt and water will be captured in a containment tank. Wash waters will periodically be trucked to the waste water treatment plant to maintain suitable storage capacity. Additional periodic maintenance will be required to remove sediment accumulations, which will be solidified and loaded into transfer trucks to be shipped to the John Street TCRA staging pad.
- Paved Surface Management—EQ will provide a power broom with a water tank to perform housekeeping of the paved work areas.
- Dust Control—EQ will provide a water truck for dust control for the mixing area and truck route.
- Fuel Station—EQ will perform fueling of heavy equipment stationed remotely from the John Street TCRA Support area with saddle tanks mounted on EQ/Team Subcontractor service trucks. EQ will also provide emergency spill control kits that will include drums, oil dry, adsorbent pads, and a boom to address small spills that will be staged adjacent to designated fueling area.
- Sediment Curtain—EQ will install one or more Type II sediment curtains downstream of sediment removal operations perpendicular to the stream flow. Additional curtain(s) will be installed downstream of the cofferdams and bypass pumping discharge pads.
- Silt Fence—EQ will install a silt fence at the bottom of the slope between SA5D-1 and SA5D-17 along the east bank of the creek, at the bottom of the slope between SA5C-1 and SA5C-7along the east bank of the creek, and as needed along the east and west banks of SA5A. Additional silt fencing will be installed as needed.
- Mulch Blanket—EQ will install additional mulch blanket as needed.
- Rock Discharge Box(es)—When EQ isolates an excavation area, bypass pumping will be required to maintain creek flow. EQ intends to address the entire sediment removal area by dividing it into multiple isolated sections and completing dredging, post removal toe-of-bank stabilization, and backfilling one isolated section at a time before isolating an adjacent section. EQ will install rock discharge pads downstream of each isolated section through which the discharge lines of the bypass pumps will be directed to release their water. The

rock discharge box will consist of partially submerged gabion baskets or pads, which will be moved as work progresses.

- Turbidity Monitoring Station—EQ will establish turbidity monitoring station(s) to monitor the turbidity levels during removal operations. Real time turbidity monitoring will be performed with stations set 300 ft upstream, 200 ft downstream, and 300 ft downstream of cofferdams set at each area. Turbidity monitoring will be recorded on half-hour intervals by a programmed data logger at the turbidity station. Other readings may be collected based on field conditions such as presence of visible runoff to the creek in the work vicinity, or as part of mitigation measures. Data will be transferred to a computer in the EQ command post trailer via a cellular modem. Further details concerning turbidity monitoring and corrective action measures are presented in EQ's Field Sampling Plan Portage Creek Removal Area dated August 2011.

Additional environmental controls will be implemented as needed to supplement pre-construction controls as work progresses and site features are impacted by the sediment remediation activities.

3.1.6 Access Road Construction

EQ will need to construct access roads in three areas to facilitate dredging operations. In order to dredge SA5D, an access road extending from Lake Street north to E Crosstown Parkway will need to be constructed parallel to the east side of Portage Creek. Truck turnouts will be installed at the north and south ends of the access roads to allow trucks to turn around in the opposite direction. To facilitate dredging and sediment transfer on Axtell Creek an access road will need to be extended from the edge of the pavement on the northeast corner of the of the John Street TCRA Support Area east to within 30 feet of the confluence with Portage Creek. The third access road that will need to be constructed will run north from E. Crosstown Parkway to Vine Street along the east side of Portage Creek to facilitate dredging and material transfer in the SA5C Dredging Area. The access road layout is depicted on Attachment 1, Figures 4 and 5, SA5C Dredge Area and SA5D Dredge Area, respectively. The access road will serve as a work bench for the excavators when removing sediments from the top of the creek bank, and as a service road to allow sediment transfer vehicles to enter the site, be loaded with sediment, and exit the respective dredging area to transfer material back to the John Street TCRA support facility to stage and stabilize sediments prior to shipment for final disposal. Transfer trucks will enter and exit the sediment removal area through these access roads.

EQ will install an 8-ounce geotextile underlayment with a 6-inch-thick layer of 1- to 3-inch rock covered by a 2- to 3-inch layer of <1 inch gravel or utilize construction mats when traversing over vegetated areas. This roadway will be 20 feet wide where possible to allow for 2-way truck traffic and be a minimum of 12 ft wide where space is limited.

EQ will also need to construct a temporary bridge over Portage Creek and extend an access road from the bridge to facilitate the movement of exhumed sediments to the John Street TCRA Staging Pad from SA5D. The tentative bridge location will be through the SA5D-7 grid Area. EQ intends to use a modular steel/aluminum bridge. Temporary bridge installation will begin with placing timber mats to obtain ground clearance for bridge installation above creek elevation at the creek's edge. The bridge will consist of two steel sections, which will be installed side by side across the span of the creek on top of the timber mat foundations. The bridge sections will be lifted and set on the timber mat foundations with a crane. Once the first span is installed, the next span will be installed working from the span previously installed following the same general procedure as described earlier.

Poles with flagging will be attached to the bridge sides to provide a visual indicator of the side edges of the bridge for dump truck drivers to align themselves with when traversing over the bridge.

3.1.7 Dredging Area Isolation

EQ will install a series of sheet pile cofferdams to isolate the dredging areas and facilitate dewatering to permit "dredging-in-the-dry" of the contaminated sediments. EQ intends to subdivide SA5D dredging into five isolated sections to facilitate sediment removal operations. The proposed isolated sections are SA5D 1-8 and SA5D 9-17. EQ intends to subdivide Axtell Creek dredging into three isolated sections to facilitate sediment removal operations. EQ intends to subdivide SA5C dredging into two isolated sections to facilitate sediment removal operations. The proposed isolated sections are SA5C 1-2 and SA5C 3-7. EQ intends to subdivide SA5A dredging into two isolated sections to facilitate sediment removal operations. The proposed isolated sections are SA5A 1-3 and SA5A 4-6.

EQ may modify this approach once the dredging activity has started. In addition to installing dams across the creek channel, EQ may install smaller cofferdams around storm drain outlets to further isolate the dredging areas from storm water drainage. There are two 60-inch outlets located near the west end of Axtell Creek and one 12-inch outlet in the center of the dredging area. The SA5C dredging has three 12-inch, one 15-inch, and one 24-inch storm water outlets. The SA5A dredging area has one 12-inch and one 15-inch storm water outlet. EQ may set by-pass pumps and appropriate hoses/piping to facilitate pumping from the storm outlets to downstream of the excavation areas.

All cofferdams will be completed to an elevation approximately 6 inches above the average creek water level elevation. The elevation completion height has been specified by USEPA to allow storm water overflow into the isolated excavation area in the event of by-pass pumping failure and/or a storm event to prevent upstream flooding due to sediment removal operations.

3.1.8 By-Pass Pumping

EQ will provide a dewatering subcontractor to perform by-pass pumping operations and isolated dredging area dewatering. By-pass pumping will consist of rerouting three distinct sources of water away from the isolated dredging area and discharging it back into the creek below the downstream isolation cofferdam. The three water sources are listed below:

- Creek channel flow
- Storm water outlet flow
- Groundwater recharge to creek

Creek channel by-pass pumping will consist of capturing the stream flow from the creek from above the upstream isolation cofferdam and pumping it past the downstream isolation cofferdam and discharging captured creek waters on a rock discharge pad installed by EQ. By-pass pumping capacity will be specified to exceed 2 times the average creek flow of approximately 45 cfm. The subcontractor will also be required to provide redundant pumps and ancillary equipment to allow for maintenance of the pumping systems without impacting dredging operations. There may be exceptions to this specification when performing by-pass pumping around isolated areas where suitable work space is unavailable to operate multiple discharge lines for redundant pumping systems. By-pass pumping operations will be described in the subsequent water management subsection. The by-pass pumping systems will be installed prior

to installation of the up/downstream isolation cofferdam. Attachment 1, Figure 7, Typical By-Pass Pumping Layout, depicts the general layout for the pumping equipment and discharge line for the isolated sections undergoing sediment removal. Timber mat bridging will be utilized as needed to bridge over pipelines in work areas.

Storm water outlet by-pass pumping may be performed as needed from storm sewer outfall(s) that have been coffer dammed to prevent flow into an active excavation area. Pumps and ancillary equipment will be sized to meet the maximum capacity of the storm sewer outlets described in Section 3.1.7 of this technical memorandum.

Groundwater pumping will be performed to minimize groundwater recharge to the isolated creek dredging areas to minimize dredging area sediment dewatering and subsequent waste water treatment. This will be accomplished by installing groundwater depression wells and pumping systems outside of the creek channel boundaries to depress the groundwater table below the maximum excavation depth. The size, number, and location of depression wells will be subject to land access outside the creek channel footprint. Groundwater will be direct discharged into the creek channel downstream onto a rock discharge pad.

3.1.9 Dredging Area Dewatering

EQ will provide a dewatering subcontractor to perform isolated dredging area dewatering. The subcontractor will then install a series of 1.5-inch sipper wells using a jetting probe. The sipper wells will consist of 1.5-inch tubes jetted to an approximate depth of 10 feet below the creek bottom surface elevation. Tubing will connect the sipper wells through control valves connected to a manifold pipe. The manifold pipe will be connected to a vacuum pump that discharges to the rock discharge pad. A vacuum will be placed on the sipper wells to extract water from the sediment. Several days of pumping will be permitted prior to the start of dredging to remove the maximum amount of moisture from the sediments prior to dredging. This will facilitate sediment removal with minimal solidification at the removal area. Minimizing water content in sediment has the following benefits:

- Requires less solidification material, thus lowering the purchase cost of solidification material.
- Decreases water weight in sediment, thus reducing disposal cost by reducing disposal tonnage.

- Decreases volume of solidification material, thus decreasing waste volume and tonnage disposal costs.
- Reduced use of solidification material reduces dust control issues associated with solidification.

The end result is a cost and safety benefit. Attachment1, Figure 7, Typical Water Management Pumping, depicts the general configuration of groundwater depression wells and isolation area dewatering sipper wells.

3.1.10 Pre-Excavation Topographic Survey

EQ will coordinate with the EPA FIELDS Group to perform a pre-excavation survey of the removal area to fill in data gaps not captured when surveying the transect lines. This survey data will be used for multiple purposes. First, it will document the pre-removal topographical condition of the creek channel. This serves as a baseline to measure the performance of contaminated sediment removal and creek channel stabilization/backfill activities. To accomplish this, the survey data will then be loaded into the Real Time Kinematics–Global Positioning System (RTK-GPS) equipment mounted in the excavators used for dredging to guide excavation/backfill efforts and ensure the lateral/vertical extent of contaminated sediment removal and backfill restoration is performed correctly.

3.2 Contaminated Sediment Removal

Contaminated sediment will be removed in basically the same manner for SA5D, Axtell Creek, SA5C, and SA5A. Sediment will be removed from the top of the bank with a long-reach excavator equipped with RTK-GPS equipment. The targeted removal grids will be isolated with sheet pile cofferdams from upstream and downstream. Bypass pumping will be performed to maintain creek flow and storm water drainage. The isolation area will be de-watered. Sediments will be solidified sufficiently in place to allow transfer dump trucks to move material to the John Street TCRA Staging Pad for final dewatering/solidification and subsequent shipment for disposal. Exhumed material will be transferred to the John Street TCRA Staging Pad either by off-road dump trucks over the site-constructed haul road or over-the-road dump trucks and public roadways subject to the location of the removal area. Post-removal sampling will be performed to verify that cleanup objectives have been met. Once isolated removal area

objectives have been meet, toe of bank stabilization and backfilling will be conducted along with survey verification. The upstream cofferdam will be removed and re-installed at the downstream end of the next section of removal grids. Water management equipment will be reconfigured for the next section. This overall general process will be repeated until all removal grid sections covered by this technical memorandum have been completed. TSCA and non-TSCA sediments will be segregated on the John Street TCRA Staging Pad and minimize potential for cross contamination from storm events during the removal period. Table 5 summarizes the order for completion and the sediment transfer method to the John Street TCRA Staging Pad.

Table 5. SA5 Sediment Grid Removal Sequence

Sediment Removal Sequence	Slope Area Grids per Removal Section	Transport Method to John Street Staging Pad or Disposal Facility
1	AXC 1-5	Off-Road Dump Truck
2	SA5D 1-8	Off-Road Dump Truck
3	SA5D 8-17	Off-Road Dump Truck
4	SA5C 1-3	Over-the-Road Dump Truck
5	SA5C 4-7	Over-the-Road Dump Truck
6	SA5A 1-3	Over the Road Dump Truck
7	SA5A 4-6	Over the Road Dump Truck

3.2.1 Water Management

By-pass pumping operations will begin before installation of the groundwater de-watering system and isolation of the dredging area with sheet pile cofferdams. By-pass pumping will operate 24 hours per day 7 days per week until the isolated dredging area is dredged, the area is confirmatory sampled, toe of bank stabilization is completed, and the area is backfilled. By-pass pumping will be terminated during rain and associated flooding events that exceed pumping capacity, and creek flow will be permitted to enter the isolated dredging area; by-pass pumping will resume subsequent to flood crest. The discharge of by-pass pumping waters will not require a Substantial Requirements Document (SRD).

Next, the isolation area dewatering pumping system will be operated 24 hours/day 7 days/week until the isolated dredging area is dredged, the area is confirmatory surveyed/sampled, bank

stabilization is completed, and the area is backfilled. Water from the isolation area dewatering will be sent to the same discharge pad as the bypass pumping system.

3.2.2 Dredging of SA5D

3.2.2.1 Sediment Removal

EQ will dredge contaminated sediments from the isolated Grid SA5D Grid Areas using a top-of-bank dredging approach subsequent to surface dewatering the isolated sections. Dredging will initially be performed in Axtell Creek. Subsequent to completing the dredging of Axtell Creek, dredging will start in SA5D addressing isolated areas in the order presented in Table 5. By-pass pumping and isolation area dewatering equipment and pipelines will be installed on both the east and west side of Portage Creek. EQ will dredge the isolated areas from atop the eastern bank with a long-reach excavator equipped with a RTK-GPS. EQ will solidify sediments in the creek bed or in solidification boxes (as/if needed) to prepare them for transfer to the John Street TCRA Staging Pad. EQ may use one or a combination of three solidification materials that include Calciment®, crystallized polymer, and/or corn cob grit. If and when a solidification box is used, EQ will place the material into a sediment solidification box that will be pumped free of latent water before solidification. The long-reach excavator will use a smooth-edge bucket to exhume sediments to the target depth for the individual grid area being exhumed, clearing sediment from the west bank to the east bank as removal progresses to the north in a downstream direction. Once sediments are sufficiently solidified, the excavator operator will load transfer dump trucks, and material will be sent to the John Street TCRA Staging Pad.

3.2.2.2 Contaminated Sediment Removal and Transfer to Staging Area

Off-road dump trucks (ORDTs) will access the site from the temporary bridge constructed over Removal Grid SA5D-7. ORDTs will advance to the respective isolation area for loading and will return to the John Street Staging Pad to deposit their loads on the east end of the staging pad. ORDTs will back up an approach ramp to the staging pad, and will raise their dump bed after cresting the top of the berm. Heavy equipment on the staging pad will remove material from the dump area to ensure ORDTs are not tracking into dumped sediments. ORDTs will then return to isolation areas for continued loading. The load-out area at the creek side will be covered with plastic sheeting draped back into the active excavation area to allow for containment and

recovery of spillage from loading operations. Excavator operators will take special care during loading so as to not spill sediment.

3.2.2.3 Post-Excavation Sampling

EQ will support the START contractor in post-excavation sampling of the contaminated soil removal area following the methods and procedures described in the confirmation sediment collection sampling described in the FSP. EQ will provide laboratory analyses through a competitively procured laboratory. Sampling and analyses will be performed in accordance with the QAPP and FSP prepared by EQ for the site dated September 2011 and August 2011, respectively. Sampling locations will be marked in order to document locations during post-excavation survey operations. Turnaround time for sample analyses will be determined at/or near the time of collection subject to time constraints with other site operations. Excavation will proceed to the initial target depth, and if visual contamination is still apparent in the grid(s), samples will be collected in every other grid of the slope area to verify remaining contamination. If over-excavation is warranted in a particular grid(s), it will be over-excavated until visual evidence of paper sludge or contaminated sediment has been removed. At that time, samples will again be collected in each grid. If cleanup performance standards/goals are met in each grid, backfilling the excavation will proceed. If any grid fails to meet performance standards/goals, the excavation and sampling process will be repeated as needed (or as directed by the EPA OSC) prior to backfilling.

3.2.2.4 Post-Excavation Survey

EQ will coordinate with the EPA OSC to provide post-excavation elevations by taking at least 3 final depth measurements in each grid using the RTK-GPS system on the excavator. EQ will provide the measurements to the EPA OSC to facilitate the make required volume removal calculations by the EPA FIELDS group.

3.2.2.5 Toe of Bank Restoration

Toe of banks will be restored as described in EQ's Restoration Plan dated September 2011.

3.2.2.6 Backfill of Creek Bottom

EQ will deploy backfill using rip rap, river rock, and a sand and gravel mix (bank run) to backfill the creek bottom in accordance with EQ's Restoration Plan dated September 2011.

3.2.2.7 Post Backfill Survey

EQ will coordinate with the EPA OSC and EPA FIELDS Group to conduct post-backfill surveying of SA5D. EPA FIELDS Group will prepare as-built drawings and make required volume removal calculations.

3.2.3 Dredge Axtell Creek

Axtell Creek will be subdivided into two isolation sections as described in Table 5. Dredging will be completed by using a long-reach excavator from atop the southern bank of Axtell Creek to dredge the grid areas in the dry region. Dredging will be conducted from west to east. By-pass pumping and excavation area dewatering equipment/pipelines will be installed along the south creek bank. 3- or 4-inch lay flat discharge line will be extended to the WWTP at the John Street TCRA Support Area located adjacent to the removal area for processing of isolation area contaminated water.

Solidification/loading/transfer of creek channel sediments will be performed in a similar manner as described in Section 3.2.2 of this Technical Memorandum. Material transfer will be completed by ORDTs traveling to/from the John Street TCRA Staging Pad to the access road along Axtell Creek. Loaded trucks will back onto the south end of the staging pad to dump their loads of sediment. TSCA and Non-TSCA sediments will be further solidified, as needed, and staged separately for subsequent loading and shipment to their respective disposal facilities.

3.2.4 Dredge SA5C

Dredging in SA5C will be conducted in a similar manner as SA5D. Dredging will be performed south to north in a downstream progression. By-pass pumping and excavation area dewatering equipment will be positioned on the east and west sides of the creek, and excavation will be performed from the east side of the creek. By-pass pumping and isolation area dewatering will be conducted following the same approach previously described.

The difference between SA5C and other areas is how the sediments will be loaded and transferred to the John Street TCRA Support Area. Off-road dump trucks will be used to transfer the material across Crosstown Parkway and along the east bank in Upjohn Park, and over the temporary steel bridge to the John Street TCRA Staging Pad for preparation for final disposition.

3.2.5 Dredge SA5A

EQ will complete sediment removal at SA5A in a similar manner as SA6. SA5A will be dredged with a long-reach excavator from atop the eastern bank in two isolated sections (SA5A 1-4 and SA5A 5-6). The following paragraphs describe variations to the general approach.

By-pass pumping and isolation area dewatering equipment will need to be stationed on the E Dutton Street bridge and along the east and west banks.

EQ may need to install shoring structures along the concrete retaining walls located along the creek in this removal area,, though it is understood that previously damaged portions of this wall may fail. This will be subject to the pre-removal survey performed by the structural engineer. The type/method of shoring will be designed to enable the structural engineer retained by EQ to perform the pre-removal assessment of structural features.

EQ will load and transfer of exhumed sediments back to the John Street TCRA Staging Pad via over-the-road trucks. Protocols established earlier in this technical memorandum for truck loading, washing, load covering, etc., will be followed. Trucks will follow will leave the SA5A staging area proceeding east on E. Dutton Street to Portage Road, then south to E. Vine Street, turning right (west) and continuing straight on Crosstown Parkway to the John Street TCRA Support Site. The trucks will return to the SA5A staging area following the route used to access the John Street TCRA Support Site in reverse.

3.2.6 Site Restoration

3.2.6.1 Removal of Excavation Facilities and Equipment

EQ will remove non-essential facilities and equipment from the work area to restore the site to pre-existing conditions. The fuel tank, excavation equipment, tire wash station, cofferdams, pumps, pipelines, etc., will be removed.

3.2.6.2 Restoration Planting

EQ will perform restoration planting as described in EQ's Restoration Plan dated September 2011. The final restoration design plan will include stakeholder input accepted by EPA and directed to EQ.

3.2.6.3 Restoration Planting Monitoring

EQ will provide monitoring and corrective action/maintenance for a period of 1 year from the restorative planting date or as directed by EPA in accordance with EQ's Restoration Plan dated September 2011. EQ will also maintain erosion sediment controls until re-vegetation planting is accepted or as directed by EPA.

3.2.6.4 Facility Impact Repair

EQ will make repairs to the sediment removal sites caused by sediment removal operations. EQ, EPA, and appropriate City of Kalamazoo management personnel will review pre-existing photo-documentation to develop a punch list of any necessary repair items to be addressed prior to complete demobilization from the SA5 contaminated sediment removal area. EQ anticipates (at a minimum) that this will include perimeter fence repair/replacement, lawn repair and landscaping of disturbed areas, asphalt/concrete patching, and general housekeeping.

ATTACHMENT 1

FIGURE

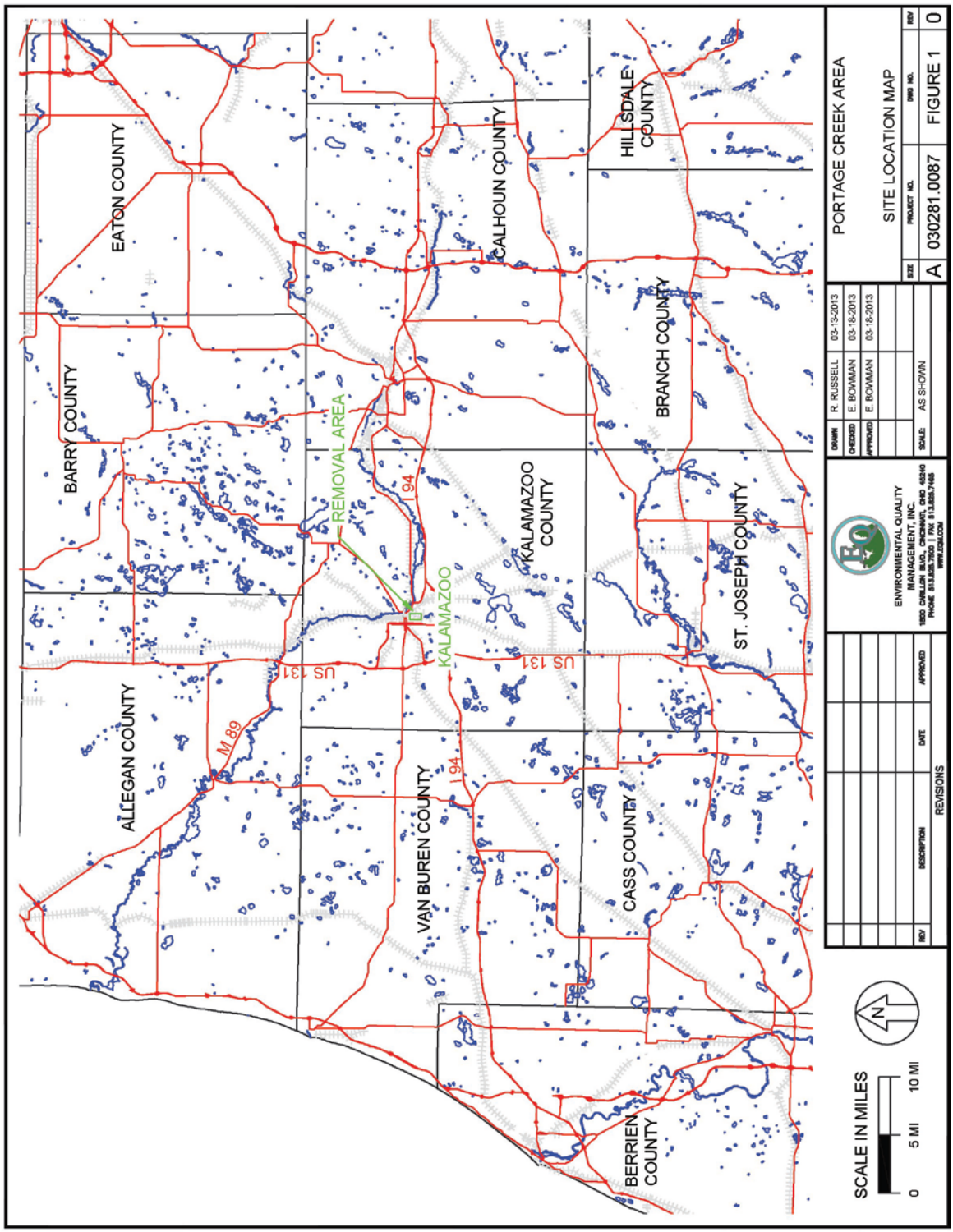

Figure 1. Site Location

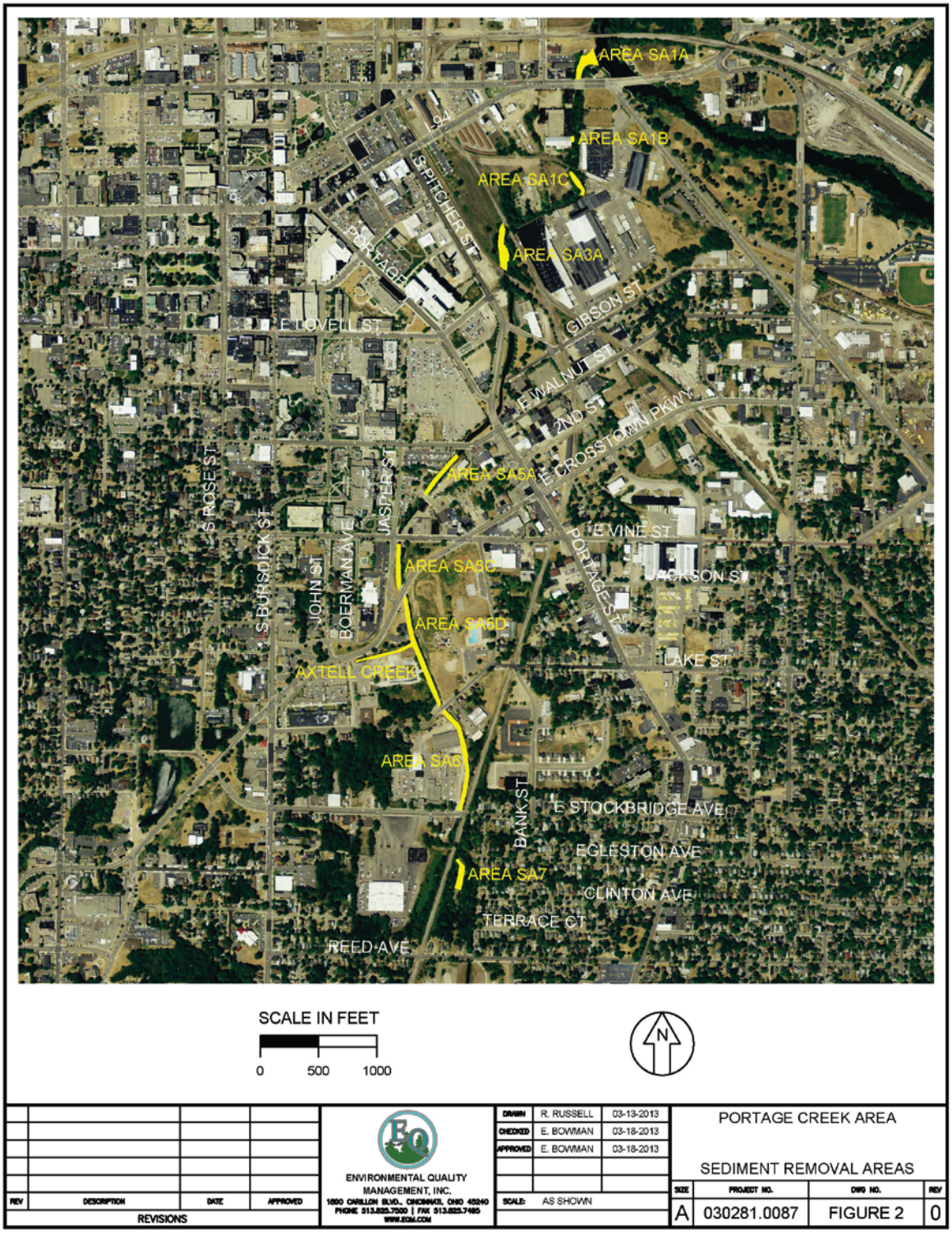

Figure 2. Sediment Removal Areas

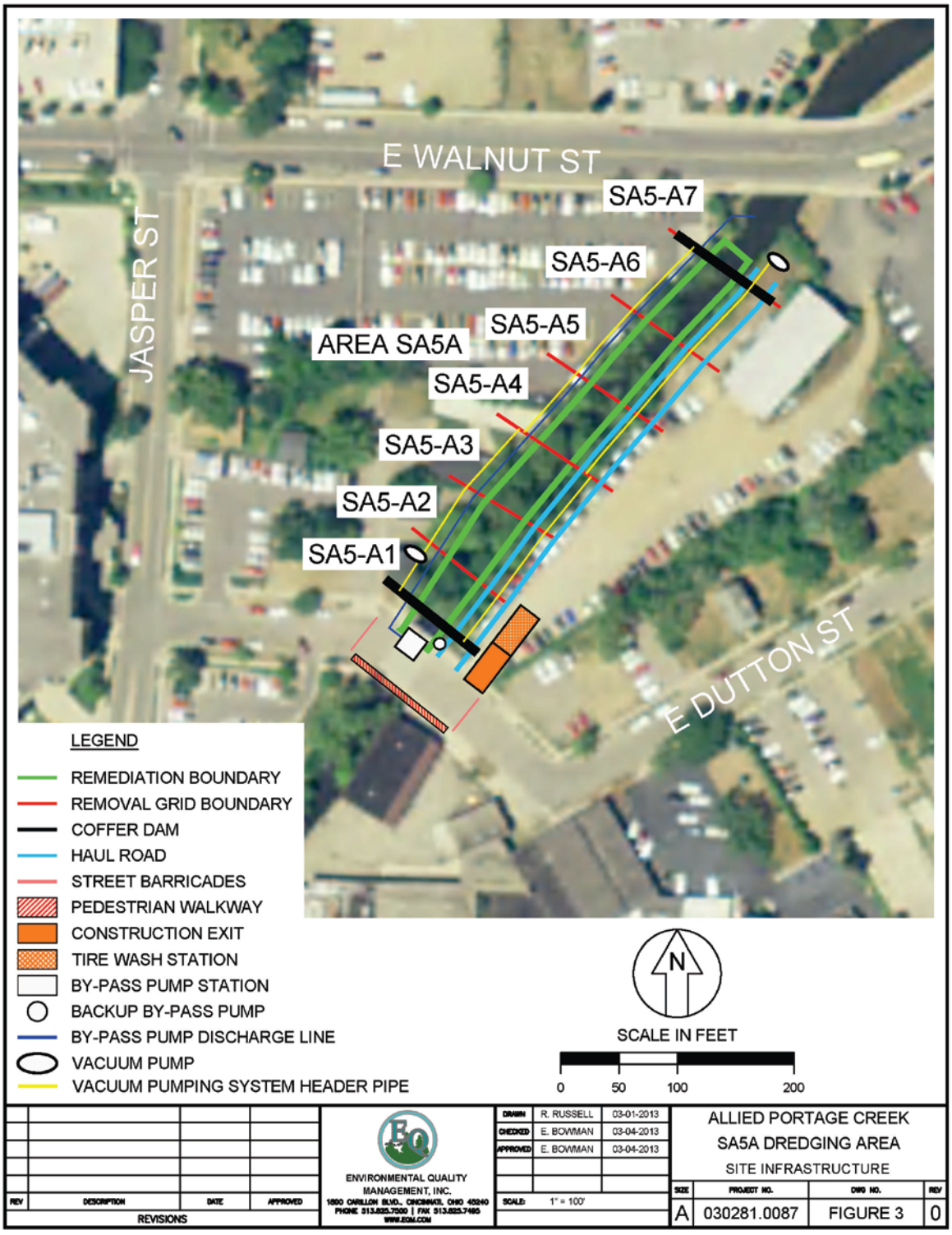

Figure 3. Allied Portage Creek SA5A Dredging Area Site Infrastructure

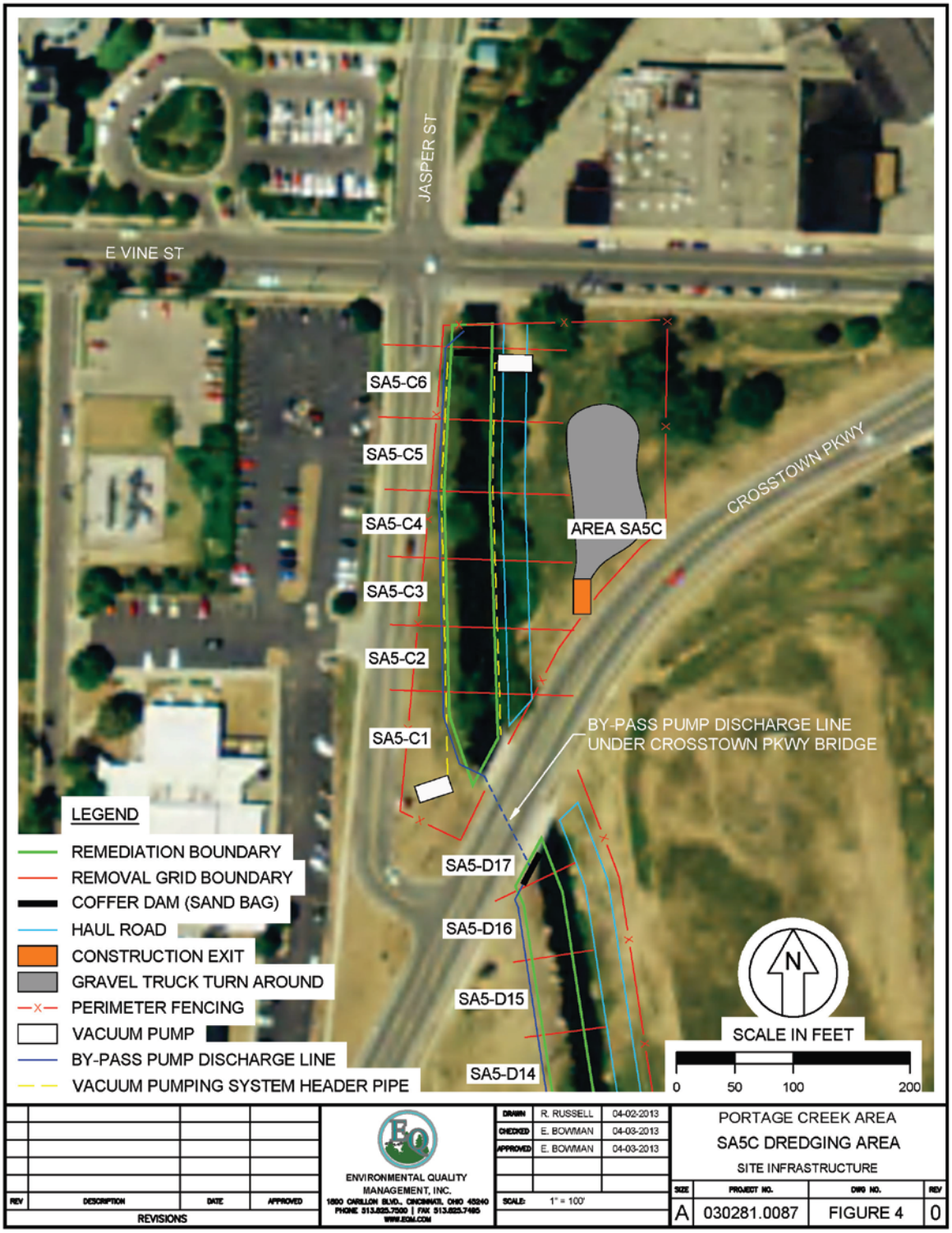

Figure 4. Allied Portage Creek SA5C Dredging Area Site Infrastructure

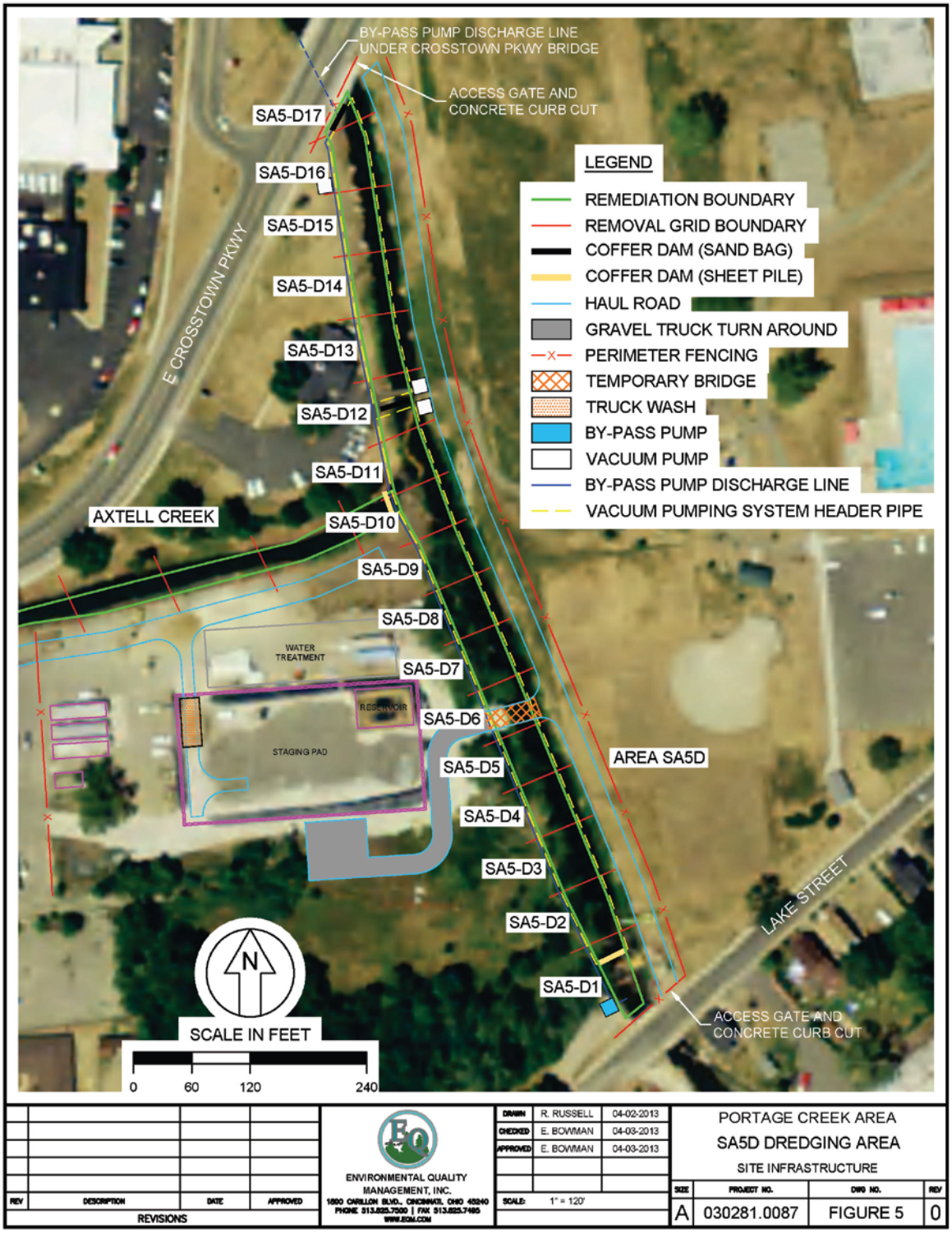

Figure 5. Allied Portage Creek SA5D Dredging Area Site Infrastructure

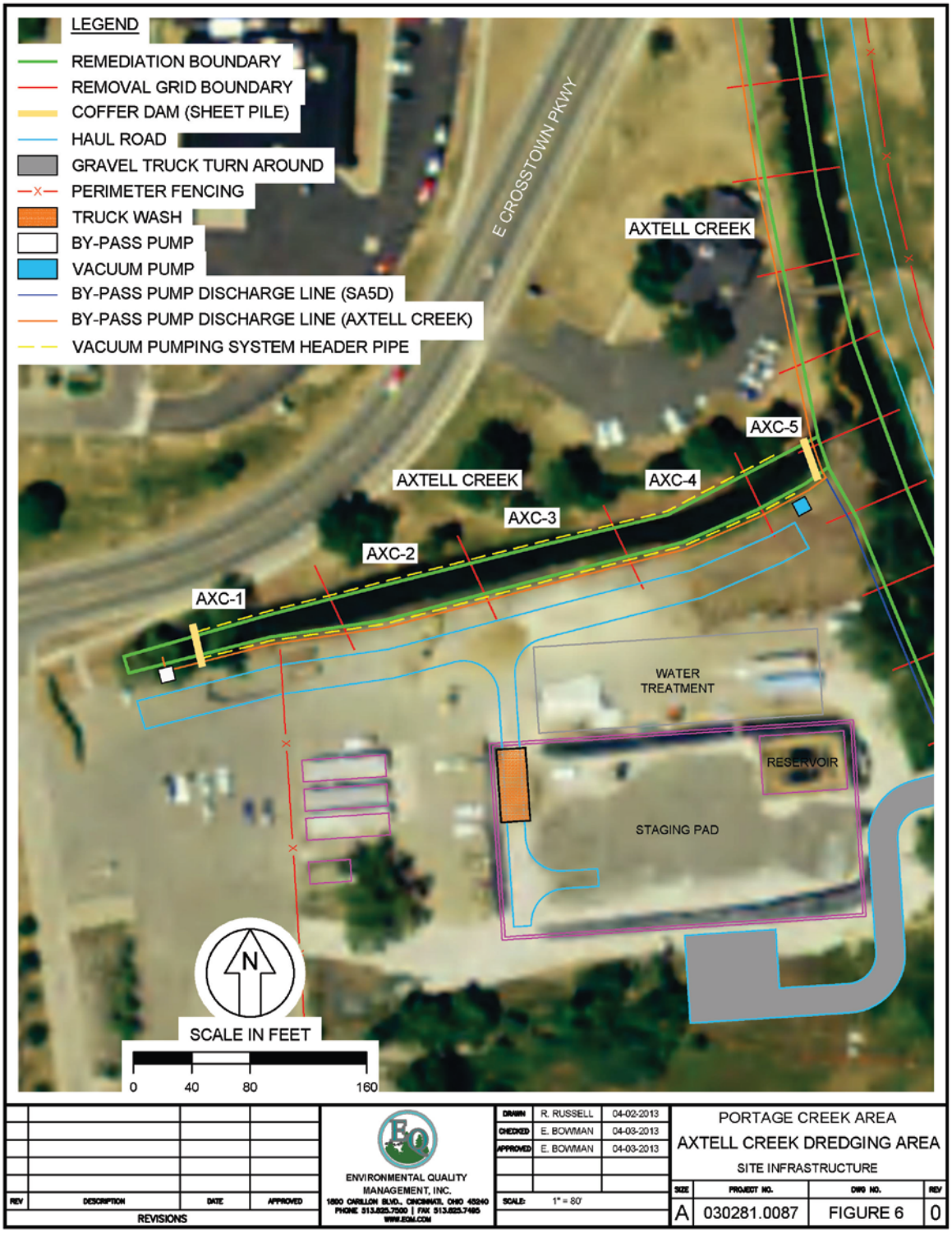

Figure 6. Allied Portage Creek Axtell Creek Site Infrastructure

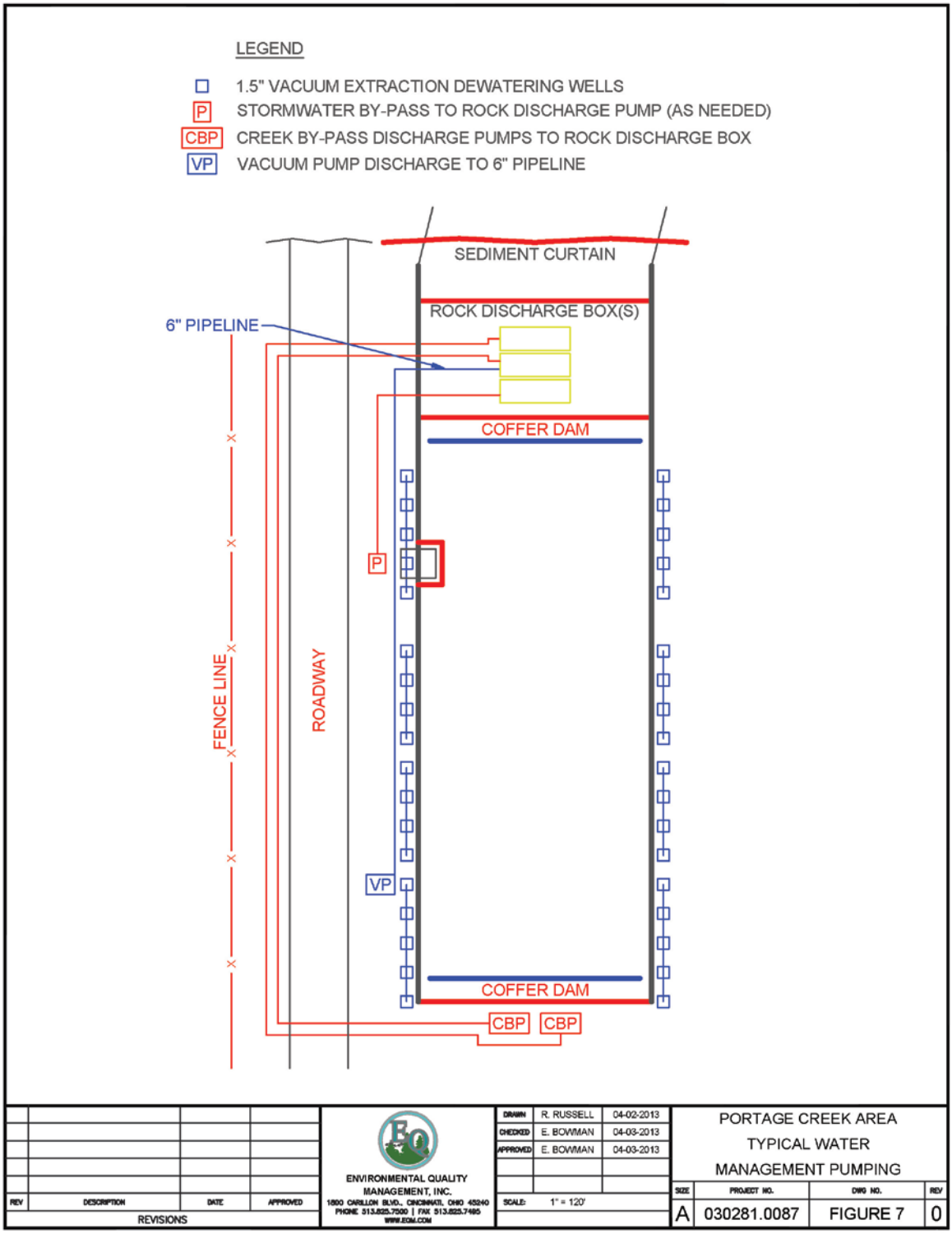

Figure 7. Typical Water Management Pumping